DIVISION ON SOLAR PHYSICS

An Umbral Model Atmosphere Derived from Infrared Observations. - W. R. PAUL, Kitt Peak National Observatory, and R. W. NOYES, Smithsonian Astrophysical Observatory. - We have used pairs of high-resolution umbral and photospheric spectra observed simultaneously in the 1-5 μm region of the infrared to determine an umbral model. The data permit evaluation of the true umbral continuum intensity relative to that of the photosphere with an accuracy of ± 2%. As the photospheric temperature structure is known and H opacity increases as T^2 beyond 1.6 μm, the umbral temperature is obtained as a function of T_55 for 1 < T_55 < 4.5 to ± 40 K. Once this has been established, lines of the vibration-rotation bands of molecules such as CO, SiO, OH, H_2O, HF and HCl can be used to probe umbral conditions in the shallower layers. Lines of CO are particularly useful as there are lines of known parameters with a wide range of excitation potential and strength. Optical depth unity occurs deeper than T_55 ~ 0.4 in the cores of weak, high-excitation lines and as shallow as T_55 ~ 10^6 for strong, fundamental lines. Observations of 4 large, stable umbrae indicate only minor variations in temperature structure (and magnetic field) from one spot to another. We have accordingly adjusted the run of temperature with r of a hydrostatic equilibrium similar model to obtain optimum fit to the combined data. There is no indication of a temperature minimum out to T_55 < 10^6 where the temperature is observed to be 2900 K.

Evolution of Coronal Heliums During the Ascending Phase of Solar Cycle 20. - R. T. Hansen, S. F. Hansen, G. A. Newkirk, R. M. MacQueen, J. T. Gosling, and A. T. Poland, High Altitude Observatory. - The principal polar-crown coronal helium structures were selected from nearly three years (May 1965 - January 1968) of K-coronameter observations made at Haleakala and Mauna Loa, Hawaii. Six isolated and long-lived helmet systems were found at latitudes of 45° and above. Their developments are compared with underlying chromospheric and photospheric activity and a simple phenomenological model is presented showing that a coronal system is formed over an active region. Thereafter the center of gravity of the system gradually drifts poleward with the trailing unipolar magnetic region (UMR), and it becomes a high latitude coronal helmet, arched over a polar-crown filament. By comparison of these coronal helmets with observations of the outer corona (to 4 R_e) made at solar eclipse, lunar sunset, and with balloon and rocket-borne externally occulted coronographs, it appears that ground-based K-coronameter measurements to a distance of 1.5 - 2.0 R_e are sufficient to detect the coronal streamers.

Observations of Coronal Forms: 7 March - 7 June 1970. - R. T. Hansen, S. F. Hansen, G. A. Newkirk, R. M. MacQueen, J. T. Gosling, and A. T. Poland, High Altitude Observatory. - On July 7 1970 the solar corona between 1.5 and 6.0 radia was photographed with a balloon-borne instrument - the engineering prototype model of the Apollo Telescope Mount coronagraph. Using synoptic observations from ground-based coronameters at the HAO Mauna Loa station the latitude and longitude of the base of each feature may be estimated. Ninety-two days earlier, on July 7 1970 the corona was well-observed at eclipse; changes in the coronal forms between the two dates will be discussed.

Interferometric Observations of Small Solar Continuum Features. - J. W. HARVEY, Kitt Peak National Observatory. - Wavefront division interferometry can be used to meas-

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